The sea lamprey Petromyzon marinus: a model for evolutionary and developmental biology.

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Public Summary:
We describe the reasons for studying the early embryonic development of the sea lamprey. Lampreys are the most primitive vertebrates on earth today. They have many features common to all vertebrates, but also lack important structures, like jaws, that make them vertebrates good predators. They are ideally suited to try to understand how vertebrates became different from invertebrates.

Scientific Abstract:
Sea lampreys (Petromyzon marinus) are cyclostomes, the most basal extant group of vertebrates, and are thought to have existed largely unchanged for more than 500 million years. They are aquatic, eel-shaped animals that spend a major part of their life as filter-feeding larvae called ammocoetes, inhabiting many freshwater bodies in the northern hemisphere. After metamorphosis, sea lampreys migrate to the ocean (or to the Great Lakes), where they feed on the blood and bodily fluids of salmonid fish and ultimately return to freshwater streams and rivers to spawn and die. The unique evolutionary position of lampreys and the relative ease of obtaining mature adults and embryos make this animal an ideal model for investigations into early vertebrate evolution. Studies of features shared between lampreys and jawed vertebrates, but distinct from those in nonvertebrate chordates, have provided information on the origin and evolution of hallmark vertebrate characteristics such as the neural crest, ectodermal placodes, and jaw. In addition, studies of features that are unique to lampreys (e.g., the variable lymphocyte receptor-mediated immune system) provide insights into mechanisms of parallel evolution (e.g., the adaptive immune system). With the establishment of techniques for the extended maintenance and spawning of lampreys in the laboratory, the sequencing of the lamprey genome, and the adaptation and optimization of many established molecular biology and histochemistry techniques for use in this species, P. marinus is poised to become an evolutionary developmental model of choice.